



## The Correlation of Sympathetic Block Elevation and Body Mass Index with the Incidence of Hypotension in Sectio Caesarea Patients with Spinal Anesthesia

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#### Abstract

**Background:** Hypotension is a frequent complication seen in spinal anesthesia. During spinal anesthesia, hypotension is more common with increasing block height, and an elevated body mass index (BMI) is considered a risk factor. **Purpose:** The aims of this research were to study the incidence of hypotension associated with spinal anesthesia for cesarean section and to relate block height to BMI. **Methods:** This is a cross-sectional correlational analytic study. A purposive sampling technique was used in picking 42 participants. The main instrument used for data collection was observation sheets. **Results:** The Spearman rank test for bivariate data showed that 35.7% of participants with a BMI greater than 25 experienced hypotension. In addition, 64.3% of participants with mild block elevation also developed hypotension. The Spearman rank test indicated a correlation value of -0.483 with a p-value of 0.001, signifying a strong and negative statistically significant relationship between hypotension and elevation of sympathetic block. **Conclusion:** There exists a significant relation between BMI and incidence of hypotension, with correlation values of -0.461 and a p-value of 0.002, further asserting that both BMI and block height are important characteristics that can be utilized in predicting the hypotension following spinal anesthesia in cesarean section patients

**Keywords:** body mass index; cesarean section; spinal anesthesia; hypotension

### Introduction

The inability to taste or feel anything is known as anesthesia. The use of reversible medications to induce a painless state of unconsciousness is known as general anesthesia. The term "local anesthesia" describes a kind of regional numbness. On the other hand, spinal blocks, nerve blocks, and plexuses remote from the sensitivity area make regional anesthesia more obvious [1]. Among the many benefits of spinal anesthesia are the following: the mother will be awake throughout the procedure, the risk of aspiration is reduced, and newborn depression is avoided. Spinal anesthesia is

the most effective method of general anesthesia for cesarean sections, although it does come with certain risks, including low blood pressure, slow heart rate, nausea, vomiting, and headache after lumbar puncture [2].

More and more babies are being born by cesarean section, which currently makes up over 21% of all births worldwide. Less developed nations have a cesarean section delivery rate of around 8%, while sub-Saharan Africa has a rate of about 5%, suggesting that this potentially life-saving procedure is not widely available. Cesarean sections are performed in 43% of births in the Americas and the Caribbean. Cervical

stents have surpassed vaginal births in five nations: Turkey, the Dominican Republic, Brazil, Cyprus, and Egypt (3). In 2018, 17.6% of all births in Indonesia were caesarean sections, according to the National Basic Health Research (Riskesdas) report for women aged 10-54. Papua province had the lowest incidence of cesarean sections at 6.7%, while DKI Jakarta province had the highest rate at 31.1%. The rate of caesarean sections in Central Java Province was 17.1% (4).

Hypotension is a frequent and serious adverse effect of spinal anesthesia. Researchers at RSUD dr. Soeradji Tirtonegoro Klaten found that 56.3% of patients experiencing hypotension during sectio caesareas performed using spinal anesthetic procedures were part of the study conducted by Puspitasari in 2019. Research conducted by Chandraningrum in 2022 at the Banjarnegara Regional General Hospital's Central Surgical Installation by Dr. Hasan Sadikin Bandung found that 21 out of 30 patients (70% of the total) who underwent spinal anesthesia for a section caesarean section also experienced hypotension.

Spinal anesthetic has a number of potential side effects, such as the following: nausea, vomiting, low blood pressure, itchiness, loss of hearing, retention of urine, headache, infection, bleeding, and even death. The three main functions of a spinal block are sensory, motor, and sympathetic. Blood pools in the extremities and viscera as a consequence of dilatation of the venous blood arteries brought on by a spinal block. Blood pools in the veins as a consequence of the vasodilation that takes place. A lower systemic resistance is the outcome of arterial dilatation. Hypotension, reduced cardiac output, and a slowing of the heart rate follow (5).

The Faradilla-researched phenomena of block height in spinal anesthesia (2022) Hypotension was

reported by all twenty patients who had high spinal blocks. There was a statistically significant correlation between the height of the block (block below thoracalis 7 and high spinal block above thoracalis 6) and the intra-spinal anesthetic MAP, according to the study by Arfin (2020).

The following are some of the risk factors for hypotension during spinal anesthesia: hypovolemia, preoperative hypertension, a high sensory nerve block, being over the age of 40, being overweight, and drinking alcohol regularly. Willianto et al. (2023) found that individuals with a Body Mass Index (BMI) more than 30 following spinal anesthesia are more likely to have hypotension. Common methods for reversing hypotension include lowering the anesthetic dosage, uterine displacement, preloading or coload, leg elevation and compression, and the use of vasopressors. Head up position after hyperbaric local anesthetic drug injection, crystalloid or colloid fluid administration before spinal anesthesia, vasopressors, left tilted uterine position in sectio caesarea, elevation of lower limbs, or wrapping them in stockings are additional methods used to prevent hypotension (6).

The number of patients who had cesarean section surgery in only one month was 82, with 61 requiring regional anesthesia, according to preliminary research carried out on December 30 at the Rejang Lebong Regency Hospital in Bengkulu. Then, on December 31, 2023, post-anesthetic hypotension was seen by three out of three patients undergoing cesarean section surgery using regional anesthesia. No comparable study has been carried out at Rejang Lebong Hospital Bengkulu, according to the researcher's conversation with the Head of the Operating Room.

In light of the above, the study's hypothesis is to investigate whether or not spinal anesthesia increases the risk of

hypotension in sectiono cesarean patients by comparing their sympathetic block height and body mass index.

## Methods

A cross-sectional design with correlation analysis was employed in this investigation. This research used a purposive sample strategy to choose 42 participants. Observation sheets were the tools used in this investigation. The study took place at REJANG LEBONG Hospital from April to June of 2024, and it lasted from October 2023 to August of 2024. All patients undergoing spinal anesthesia during a sectio caesarean section at Rejang Lebong Hospital made up the study's population. This work has been approved by the Research Ethics Committee of the University of California, Berkeley (B.L.PPM-UHB/225/04/2024).

## Result

### 1. Sample Characteristics

Table 1. Sample Characteristics Based on Age, ASA Classification, Elevation of Sympathetic Block, Incidence of Hypotension and Body Mass Index Surgery at IBS Rejang Lebong Hospital

Characteristics	n	%
Age		
21-25 Years	11	26,2
26-30 Years	15	35,7
31-35 Years	16	38,1
Total	42	100
ASA Classification		
ASA 1	14	33,3
ASA 2	28	66,7
Total	42	100
Body Mass Index (BMI)		
<18,5	2	4,8
18,5-25	25	59,5
>25	15	35,7
Total	42	100
Intra Anesthesia MAP		
<60 mmHg	30	71,4

≥60 mmHg	12	28,6
Total	42	100
Sympathetic Block Height		
High	4	9,5
Medium	35	83,3
Low	3	7,2
Total	42	100

Sixteen individuals (38.1% of the total) were within the 31–35 age bracket, as shown in Table 1. Mothers who had spinal anesthesia for a sectional caesarea had a significantly higher prevalence of ASA 2 status (66.7%), according to the parameters of ASA status categorization. Of the overall sample, 25 individuals (59.5%) had a body mass index (BMI) between 18.5-24.9. For as many as 35 out of 100 injection sites (83.3% of the total), Moderate Sympathetic Block Elevation predominated.

### Univariate Analysis

#### 1. Sympathetic Block Height

Table 2 Frequency distribution of sample characteristics based on sympathetic block height

Sample characteristics block height	Frequency	%
High	4	9,5
Medium	35	83,3
Low	3	7,2

Table 2 shows that out of the whole sample, 4 (9.5% of the total) had characteristics at the high sympathetic block height, 35 (83.3%) at the medium sympathetic block height, and 3 (7.2% of the total) at the low sympathetic block height.

#### 2. Body Mass Index

Table 3 Frequency Distribution of Sample Characteristics Based on Body Mass Index

Sample characteristics of body mass index (IMT)	Frequency	%
<18,5	2	4,8
18,5-25	25	59,5
>25	15	35,7

From the table above, it can be seen that the sample characteristics in Body Mass Index <18.5 were 2 (4.8%), then Body Mass Index 18.5-25 were 25 (59.5%), and in Body Mass Index >25 were 15 (35.7%) of the total sample.

### 3. Incidence of Hypotension

Table 4 Frequency Distribution of Sample Characteristics Based on the Incidence of Hypotension

Sample characteristics of hypotensive events	Frequency	%
Hypotension occurs	30	71,4
No hypotension occurs	12	28,6

Table 4 shows that the characteristics regarding the incidence of hypotension are mostly hypotension in pregnant women with sectio caesarea performed by spinal anesthesia as many as 30 people (71.4%). While only 12 people (28.6%) who did not experience hypotension.

### Bivariate Analysis

Table 5. Relationship between Sympathetic Block Height and body mass index with Hypotension Incidence

Body Mass Index (BMI)	Hypotensive Events					
	Hypotension occurs		No hypotension occurs		Total	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
<18,5	1	2,4	1	2,4	2	4,8
18,5-25	14	33,3	11	26,2	25	59,5
>25	15	35,7	0	0	15	35,7
<b>Total</b>	<b>31</b>	<b>71,4</b>	<b>11</b>	<b>28,6</b>	<b>42</b>	<b>100</b>

  

Block Height	<i>f</i>	%	<i>F</i>	%	<i>f</i>	%
High	0		4	9,5	4	9,5
Medium	27	64,3	8	19	35	83,3
Low	3	7,2	0	0	3	7,2
<b>Total</b>	<b>30</b>	<b>71,5</b>	<b>12</b>	<b>28,5</b>	<b>42</b>	<b>100</b>

Based on table 5, it is known that samples with body mass index  $IMT > 25$  were hypotensive as many as 15 (35.7%) and those without hypotension 0 (0%) with a total of 15 (35.7%). Then samples with moderate block height had hypotension as many as 27 (64.3%) and those without hypotension were 8 (19%) with a total of 35 (83.3%).

### Spearman Rank

Table 6. Distribution of Spearman Rho Correlation Test of the Relationship between Block Height and the Incidence of Hypotension at Rejang Lebong Regional General Hospital in 2024.

<i>Spearman Rho</i>	<i>p value</i>	$\rho$ ( <i>rho</i> )
	0,001 ( $p < 0,05$ )	-0,483

According to the results of the spearman rho test applied to table 6 above, the p-value is less than 0.05, indicating that the significant relationship between block height and the incidence of intraoperative hypotension is rejected. The correlation coefficient is -0.483, indicating a moderate relationship between the height of the spinal anesthesia block and the incidence of intraoperative hypotension, with a negative correlation direction. In other words, the risk of not having hypotension increases as the block height decreases.

Table 7. Distribution of Spearman Rho Rank Correlation Test of the Relationship between Body Mass Index and the Incidence of Hypotension at Rejang Lebong Regional General Hospital in 2024.

<i>Spearman Rho</i>	<i>p value</i>	$\rho$ ( <i>rho</i> )
	0,002( $p < 0,05$ )	-0,461

The rank-Spearman rho test was used to analyze the data in the table above. The results showed a significance level of 0.002 ( $p < 0.05$ ), indicating that the p value is less than 0.05. Therefore, the null hypothesis

(ho) is rejected. The correlation coefficient (-0.461) between BMI and the incidence of intraoperative hypotension is moderate, indicating a negative correlation. In other words, a lower BMI is associated with a higher risk of not experiencing hypotension.

## Discussions

### 1. Relationship between the height of sympathetic block and the incidence of hypotension in sectio caesarea patients with spinal anesthesia

The amount of change in cardiovascular parameters is determined by the level of sympathetic block, which is in turn determined by the height of the nerve block. The amount of anesthetic block may be determined by the injection location of local anaesthetic for spinal anesthesia (11). Based on the findings of this study, there is a correlation between the height of the sympathetic block and the occurrence of hypotension ( $\rho$  (rho) -0.483), and the p-value is less than 0.05 ( $p < 0.05$ ), indicating that the p-value is statistically significant (12-14)

Consistent with Faradilla's (2020) findings, this study confirms that intraoperative hypotension is more common at IBS Sleman Hospital when spinal anesthetic blocks are taller. Twenty individuals (100%) had hypotension after experiencing high spinal blocks (8). A total of 40 participants (60.6%) had surgical or skin height blocks (blocks below thoracalis 7), 26 participants (39.4%) had high spinal blocks (blocks above thoracalis 6), and 0 participants (0%), which is consistent with the findings of Obetnego (2017), who found that block height is associated with early spinal anesthesia complications (9).

According to Taufik (2017), the height of the spinal block is one of the

variables that most affects the incidence of hypotension. This finding was supported by a Chi Square test with a significant value of  $p = 0.006$ . In contrast to those who had large spinal blocks, most people who had modest blocks reported little to no hypotension. When it came to low spinal block, 4 individuals (44.4%) reported hypotension, while 5 individuals (55.6%) reported no such symptoms. In contrast, 44 respondents (86.3%) reported hypotension in high spinal block, while 7 individuals (13.7%) reported no such symptoms.

It is believed by researchers that patients undergoing sectio caesarean section surgery are more likely to have post-spinal anesthetic hypotension if their sympathetic blocks are greater. The findings of (17-19), support this idea as well, showing that an elevated risk of hypotension is linked to a blockage height of 4 or higher. The severity of sensory impairment due to sympathetic nervous system blockage (20-22) The compensatory vasoconstriction of the upper extremities reduces the reduction in blood pressure when the height of sympathetic nerve blockade is smaller than T4. Along with the cardiac accelerator nerve fibers, this compensatory mechanism will be stopped at increasing degrees of spinal anesthetic blockage. The drop in systolic blood pressure is proportional to the amount of spinal anesthetic blockade (10).

### 2. Relationship between Body Mass Index and Hypotension in sectio caesarea patients with spinal anesthesia.

According to the study's findings, there is a correlation between BMI and the occurrence of hypotension ( $\rho = -0.461$ ), and the p-value is less than 0.05



(0.002), indicating that the p-value is less than 0.05.

This study's findings that obesity increases the risk of hypotension in patients undergoing sectio cesarean section after spinal anesthesia are in line with those of Fakhari et al. (2018). Hypotension during spinal anesthesia is more likely in individuals with a body mass index (BMI) higher than 24 kg/m<sup>2</sup>. This is due to the fact that anesthetic medications that are soluble in fat will build up in adipose tissue and then be released gradually over a lengthy duration (23)

Furthermore, this study's findings corroborate those of an earlier study by Angelica I. (7) titled "Factors Affecting the incidence of hypotension in spinal anesthesia patients at Dr. Soeradji Tirtonegoro Klaten Hospital" which found that body mass index was associated with an increased risk of hypotension in this population. This is corroborated by studies done by (12) who found that hypotension rates are significantly affected by body mass index. Also, according to studies cited by Taufik (2017), BMI significantly affects the prevalence of hypotension. The findings of his study support this idea, showing that out of 45 participants with a body mass index (BMI) greater than 25, 39 (or 86.7% of the total) suffered hypotension.

Patients undergoing sectio cesarean section surgery are more likely to have post-anesthesia hypotension if their body mass index is high, according to the researchers' theoretical model. This is related to the fact that the absorption of local anesthetics is determined by lipid content (24). After an injection, the concentration of local anesthetics in the subarachnoid space's large myelinated tissues is increased. Greater concentrations of local anesthetics are

associated with more myelination. Because BMI is not applicable to pregnant women, this research only computed it when the mother was not carrying a child.

### Limitations Research

Due to the researcher's narrow focus on the potential correlation between sympathetic block height and body mass index and the occurrence of hypotension in patients undergoing cesarean section surgery, no other variables, such as dosage or amount of bleeding, were considered.

### Conclusion

The ages of the mothers undergoing the section Caesarea with spinal anesthesia were mostly between 26-30 years and 31-35 years; in the minority was the age group of 21-25 years. The Spearman rho test demonstrated that the height of the spinal block had a statistically significant moderate negative correlation with the occurrence of intraoperative hypotension, suggesting that lower block height is associated with a reduced risk of hypotension. In the same way, this test showed a significant moderate negative correlation between BMI and intraoperative hypothetical hypotension, which implies that lower BMI is also associated with less risk for hypotension.

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### Conflict of Interest Statement

The authors have confirmed that they have no competing interests.

### Data Availability

The datasets used or generated in this study are available from the corresponding author upon reasonable request.

### Author Contributions

**Indra Pranata:** Conception and design of the study, Search Data Base, Methodology, Analysis Risk of Bias, Data Analysis and Interpretation, Writing, Review and Editing. **Asmat Burhan:** Study conception and design, search database, methodology, data analysis and interpretation, and writing, review, and editing. **Tophan Heri Wibowo:** Conception and design of the study, Search Database, Methodology, Data Analysis, and Interpretation, Writing, Review, and Editing. **Made Suandika:** Conception and design of the study, Search Database, Methodology, Data Analysis and Interpretation, Writing, Review, and Editing.

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